Low Power X-Ray Photon Resolving Imaging Array, Phase I

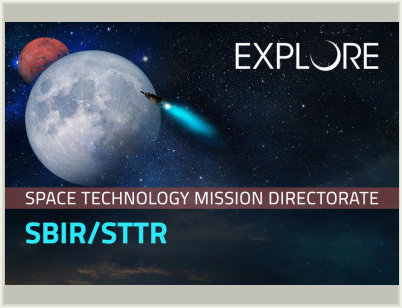
Completed Technology Project (2008 - 2008)

Project Introduction

Instruments employing X-ray detection are countless, in different sectors from medicine to industry and from basic to applied science. Given this importance, and despite existing technologies, there is still need for X-ray detection with increased system performance. The solid-state detector array is the primary technology to implement the current generation of space borne high-energy astronomy missions that are managed by NASA in partnership with the international community. Readout integrated circuitry (ROIC) specifically designed for photon resolving X-ray detection with solid-state detectors will create a new generation of high-performance X-ray imaging sensors. AC coupled detector input circuitry, similar to that used by Black Forest Engineering (BFE) for laser detection and ranging (LADAR), is ideally suited to NASA X-ray astronomy imaging system requirements. BFE proposes on Phase I to design, process and test detector input circuitry to meet a wide range of NASA X-ray imaging applications. The input circuit, when implemented into an ASIC X-ray imaging ROIC, manufactured and integrated with a solid-state detector array on Phase II, will provide single photon sensitivity, accurate X-ray energy determination, X-ray event time stamping, low power dissipation and ambient temperature operation.

Anticipated Benefits

Potential NASA Commercial Applications: This imaging technology, with single photon sensitivity, reduces dose requirements for medical and commercial X-ray imaging applications. Elimination of many other background and noise sources provides the ability to resolve X-ray energy. There is a great potential to be explored with more elaborate methods of processing single photon signals. The image sensor can use two thresholds to select an energy band out of a continuous spectrum or perform image subtraction with one X-ray illumination. While single photon imaging with X-ray sensors will not displace conventional film and continuous integration imager approaches (such as charge coupled devices), the ability to work over a wide X-ray energy range and to process those images using signal energy level discrimination methods, will improve image quality of many existing X-ray systems and create new imaging applications.



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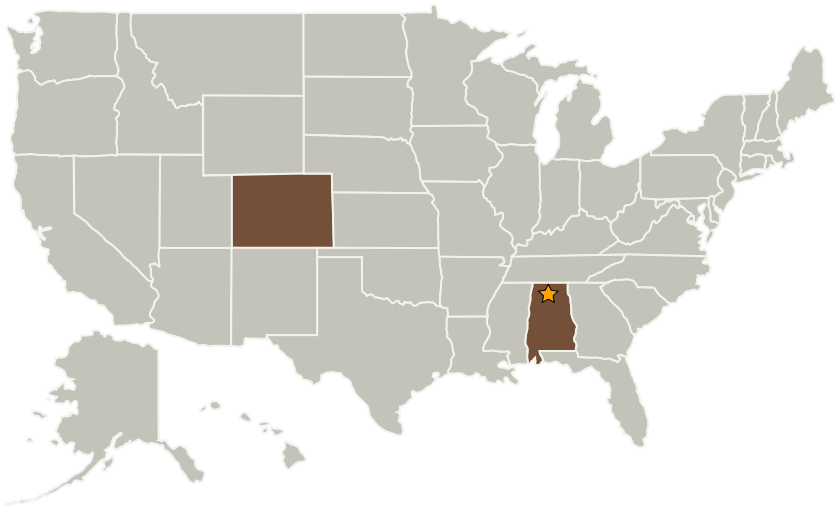
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Marshall Space Flight Center(MSFC)	Lead Organization	NASA Center	Huntsville, Alabama
Black Forest Engineering, LLC	Supporting Organization	Industry	Colorado Springs, Colorado

Primary U.S. Work Locations	
Alabama	Colorado

Project Transitions

January 2008: Project Start

July 2008: Closed out

Closeout Summary: Low Power X-Ray Photon Resolving Imaging Array, Phase I Project Image

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Marshall Space Flight Center (MSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

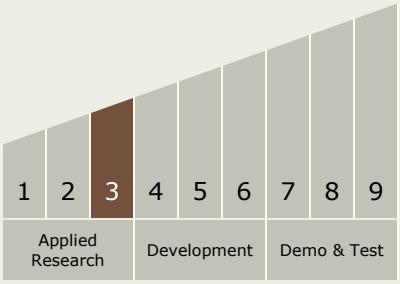
Carlos Torrez

Principal Investigator:

Stephen Gaalema

Technology Maturity (TRL)

Start: **3**



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Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes